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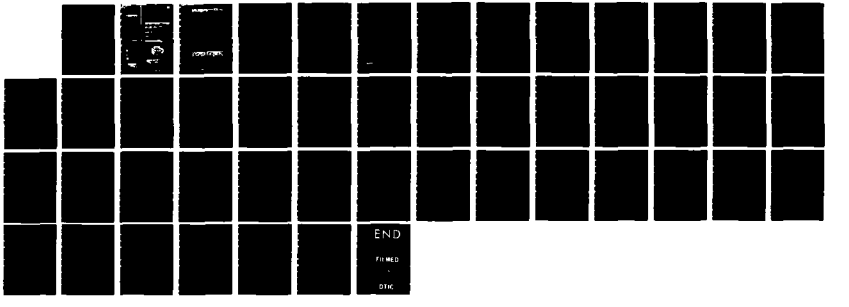

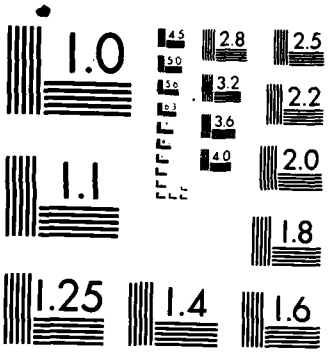

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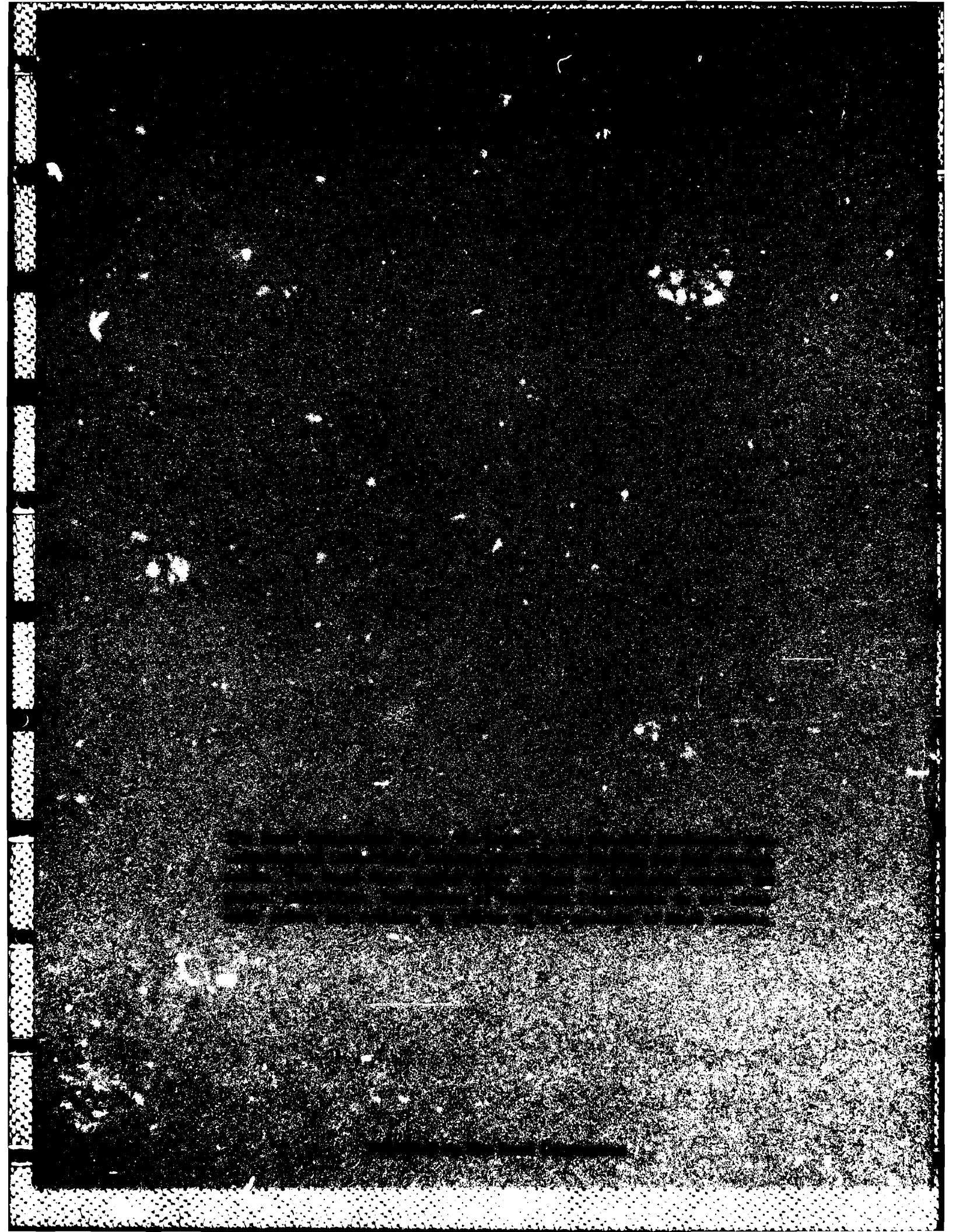

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This Note presents a structure for characterizing the temperament of alternative Red and Blue Agents, models representing national command-level decisionmakers in the Rand Strategy Assessment Center's system for automated war gaming. An agent temperament is designed to be a systematized description of the agent's general orientation concerning whether or how to wage war. Agent temperament, in conjunction with the environment in which the agent finds itself and the observed behavior of the opposing agent, guides the rules that dictate agent behaviors. A temperament is thus intended as a plausible characterization of the major dimensions in Soviet or American national command-level thinking that determine the general direction of escalatory policy and the selection of war plans. The authors propose that temperament be expressed within four general themes: strategic orientation, warfighting style, flexibility, and perception. Within each theme, the agent is defined by a number of attributes.

A RAND NOTE

CHARACTERIZING THE TEMPERAMENTS OF RED AND BLUE AGENTS--MODELS OF SOVIET AND U.S. DECISIONMAKERS

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September 1985

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PREFACE

This Note was prepared for the Director of Net Assessment in the Office of the Secretary of Defense, under Contract MDA903-85-C-0030. It is part of a larger effort by the Rand Strategy Assessment Center to model national command level decisionmaking in automated war games. The Note should be of interest to persons concerned with political-military simulation and gaming, rule-based models of behavior, U.S.-U.S.S.R. relations, and artificial intelligence.

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SUMMARY

This Note presents a structure for characterizing the *temperament* of alternative Red and Blue Agents ("Ivan" and "Sam," respectively)--models representing national command level decisionmakers in the Rand Strategy Assessment Center's system for automated war gaming. An agent temperament is designed to be a systematized description of the agent's general orientation concerning whether or how to wage war. Agent temperament, in conjunction with the environment in which the agent finds itself and the observed behavior of the opposing agent, guides the rules that dictate agent behaviors. A temperament is thus intended as a plausible characterization of the major dimensions in Soviet or American national command level thinking that determine the general direction of escalatory policy and the selection of war plans.

We propose that temperament be expressed within four general themes: strategic orientation, warfighting style, flexibility, and perception. Within each theme, the agent is defined by a number of dimensions, which we label *attributes*. The *values* of these attributes are labels that describe the various positions the agent can take on each attribute. In addition, each attribute within the strategic orientation and warfighting style themes carries a *priority rating* that resolves potential contradictions among values of different attributes and permits external pressures of the world situation to override abstract internal behavioral propensities.

In addition to the full model of temperament, we also present one example of a "short form of temperament" that characterizes an agent on the basis of five attributes. This short form permits us to focus succinctly on the key characteristics of particular Ivans or Sams, without the overhead burden of generality.

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I. OVERVIEW

The Rand Strategy Assessment Center (RSAC) is constructing an automated war gaming system permitting analysts to explore realistically a range of large-scale American-Soviet crises and conflicts (Davis and Winnefeld, 1983). The RSAC's models of the United States and Soviet Union have been designed hierarchically, in correspondence with reality, with separate decisionmaking components for the national command level (NCL) and various lower-level theater commands (Schwabe, forthcoming). The present Note deals only with the highest level of the hierarchy, the NCL.

THE NEED FOR TEMPERAMENTS

To construct models of strategic decisionmaking by American and Soviet national commands, one is faced with the task of creating models that not only have the "personalities" of the two superpowers in the grand global game, but are sensitive to the constantly changing world situation and react in role-appropriate manners. As a fair proportion of political behavior is dictated by external circumstances without regard to a power's personality, such a model must have constraints, and different personalities must have some essential elements in common. On the other hand, different powers behave differently; not only are Americans not the same as Soviets, but a single American administration is different from any other, and even the Soviet political-military strategic philosophy evolves over time. Any attempt at simulating national command decision behavior that is consistent with past real decisions and reasonably predicts projected decisions must be based at least in part on individual characteristics of these national commands.

The task of characterizing national policymakers is not a new one; it has been practiced in the form of poetic and prose descriptions since at least the time of Homer. While such descriptions can be both lyrical and insightful, they lack the precision necessary for the analytic requirements of a computerized gaming system. These descriptive characterizations must somehow be reduced to a systematic form that can

be used in a rule-governed way to select strategic plans. In this reduction, one attempts to maintain the essence of the characterization, while necessarily (and unfortunately) stripping the description of a richness and vividness that aids the human reader in comprehending the object of study.

Our approach to this problem[1] has been to describe superpower personality in the format of an "attribute list" addressing the superpower's general orientation toward political-military decisionmaking. Within our automated gaming facility, the simulated superpower NCLs are termed "major agents;" "Red Agent" refers to the Soviet command and "Blue Agent" refers to American or NATO commands, depending on context. The *attributes* are essentially dimensions along which a general orientation may be categorized. A list of attributes, which defines the superpower's personality for purposes of NCL decisionmaking, we term its *temperament*. For example, to compare three different NATO defense philosophies--one based on flexible response, one based on strong reliance on the nuclear deterrent, and one based on strong conventional defense with a no-first-use policy--the three philosophies should be expressible as different agent temperaments by specifying differences among such attributes as "nuclear-use policy" and "insistence on having the initiative in military encounters." Similarly, different possible Soviet philosophies can be constructed as temperaments. Thus, as a first approximation, the attributes are building blocks describing different possible versions of the Blue and Red agent national commands (Sams and Ivans).

Ultimately, the agent temperaments will serve two functions within the RSAC system:

- As heuristics to aid NCL rule writers by giving them a better mental image of the relevant Ivan or Sam.
- As a source of parameters (the individual attributes) to be used directly in rules concerned with issues such as escalation or finding the best operational strategy.[2]

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[1] Our approach owes much to earlier work by William Jones. See, for example, Jones (1974).

[2] In this approach one would build more generic Ivan rule sets with Ivan attributes as parameters. This would provide for more flexibility than having separate complete rule sets for an Ivan 1, Ivan 2, etc.

Thus, agent temperament is designed to serve both analytic purposes, moving from behaviors to rule-writing, and synthetic ones, moving from attributes to agent behaviors. The first function is already being achieved in ongoing work to develop alternative Ivan and Sam rule sets (Davis, Bankes, and Kahan, forthcoming). The second function is a desirable goal, but one that will further increase RSAC system complexity.

CONSTRUCTING AGENT TEMPERAMENTS

Our goal, then, is to describe the decision behavior patterns of the Soviet and American national commands that may be useful in the writing of the RSAC's rule-based artificial intelligence models. It is desirable, as much as possible, to express the differences among various Ivans or various Sams as differences in temperament. That is, if two versions of an agent would behave differently in the same situation, we would want this to result from differences among the attributes. Moreover, novel combinations of attribute values should lead to possibly novel behavior by agents.

While acknowledging that such seemingly trivial things as a key individual's hours of sleep or state of health, or the interpersonal relationships among group members, might be as important as any temperament attribute in determining the behavior of a real-life national command, the present model is an attempt to provide, at least on a psychological level, a *plausible, coherent, and consistent* basis for the many and varied decisions that an NCL might make. We do *not* claim that the results can be reliably predictive--even if the temperament image is correct.[3]

The process of choosing a temperament is itself a delicate problem; it is important that temperaments be logically and consistently constructed. If reasonable behaviors that an agent might display in a given situation are excluded by an attribute set, this should be taken as an indication of the inadequacy of that particular set of attributes.

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[3] Davis and Stan (1984) argue that the NCL model should have stochastic outputs--i.e., given an Ivan and a particular situation, the

One way to construct agent temperaments is by asking persons knowledgeable about Soviet or American decisionmaking to consider the particular Ivan or Sam they wish to examine, and would then to give a verbal description, using terms that correspond to the attribute dimensions. The listener would translate these descriptions into attribute lists, and then question the specialist as to whether or not the lists were appropriate descriptions. Disagreements would be discussed, and the lists would be amended until the specialist agreed that the agent in list form was a good approximation (missing the full richness, of course) of the Ivan or Sam it originally had in mind.

Alternatively, lacking the full range of available and cooperative specialists to construct temperaments, the writings of many experts should be consulted and employed to create attribute lists. In some cases specialist feedback will be much easier to obtain than initial consultations beginning with a blank slate.[4]

It is important to attempt to test the validity, adequacy, and appropriateness of temperaments. Two methods of checking appear feasible. The first is a sort of "backtranslation" from the attribute lists to their origins. That is, provided with a temperament in the form of an attribute list, a specialist on Soviet or American policy behavior would be asked to create a verbal description of the type of national command that would have those characteristics. This verbal description could then be compared to the original verbal description that gave rise to the temperament list. If there was a match on the essential characteristics, then the translation to temperament could be judged a success; if there were serious discrepancies, then there would be cause to doubt the validity of that particular agent temperament.

The second test awaits the actual running of the automated RSAC game. An agent created by an analyst would be used as the source of a parameter set in a standardized game. The behavior in the game of that particular agent would then be evaluated by the analyst who created it

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output might be that the IVAN will decide X with probability P_X and Y with probability P_Y. Pursuing that will be a future effort.

[4] The prototype Ivans and Sams constructed to date have followed this alternative course. Only when temperaments are firmly embedded within the larger RSAC system will it be efficient to use experts' time.

as consistent or inconsistent with intended behavior. Specialist observations would also be very helpful here.

THE STRUCTURE OF TEMPERAMENT

The structure of temperament, based on major themes expressed in a series of attribute dimensions, provides an implicit model of the agent characteristics that influence decisionmaking. In this model, an agent's decisions are a consequence of situational determinants external to temperament in conjunction with internal constraints in the form of exogenously imposed strategic orientation, warfighting style, and flexibility specifications. In addition, decisionmaking is affected by the perceptions the agent has of other agents' temperament and policy, which are themselves modifiable by both the internal constraints and the situation.

What follows is a list of proposed attributes to be used in writing decision rules for major agent (Red and Blue) NCL decisionmaking. Temperaments are being designed to be eventually applicable to all agents, but the present implementation applies only to the Blue and Red Agents.[5]

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[5] See Shlapak et al. (forthcoming) for a discussion of the Scenario Agent model, which is the RSAC representation of the national command levels of countries other than the United States or the Soviet Union.

II. THE MODEL OF AGENT TEMPERAMENT

In the model of agent temperament, four themes of temperament are defined. These are: strategic orientation, warfighting style, flexibility, and perception. The four themes of temperament constitute an agent's cognitive structure. Within each theme, attributes and their values are specified.

STRATEGIC ORIENTATION ATTRIBUTES

Strategic orientation relates to an agent's view of nuclear policy, the depth of commitment to defend each of several degrees of national interests, and various attitudes regarding the agent's role in world affairs. These attributes describe relationships with other nations as well as policy in the use of nuclear weapons and political/strategic (as opposed to tactical/military) constraints on actions. There are five attributes of strategic orientation:

- *Use of nuclear weapons* describes the nominal national policy governing the circumstances, if any, under which nuclear weapons might be employed. This is a guideline policy, which does not necessarily determine actual behavior but rather sets a baseline stance that orients decisionmaking. This attribute describes an agent's actual policy, which may differ from its publicly announced one.

- *Commitment* describes an agent's committment to the defense of different countries or regions, depending on their importance to the agent's national interests.

- *Expansionism* describes major agent attitudes toward their own empire-building ambitions. This particular attribute is of primary importance for Ivan.[1]

- *Containment* describes the opposite side of the coin of expansionism, or whether a major agent strives to reduce or contain the empire that it perceives the enemy agent to have or to be building. Even if an agent does not have expansionist ambitions, it could feel that the other agent should have its empire cut back, or at least that the other's sphere of influence should not be permitted to expand.

[1] The various Sams may, of course, differ in their perceptions of how expansionistic Ivan is; this will be treated below. Also, a given Ivan may perceive a given Sam to be expansionist.

- *Unilateralism* describes whether major agents consult relevant allies before acting. This attribute is primarily important in describing various Sams.

Attached to each strategic attribute is a *priority rating* that indicates the centrality of that particular attribute in the agent's cognitive decisionmaking structure. The higher the priority rating for an attribute, the more an agent is constrained to choose a course of action consistent with the attribute, even if situational elements and other attributes indicate the desirability of alternative behaviors. If two strategic attributes prescribe contradictory courses of action, the priority rating determines which of them will have the greater influence on the decision. For example, a situation might arise when a particular area is severely threatened by an enemy. The commitment attribute might prescribe a nuclear defense of this territory, but the use of nuclear weapons attribute might prohibit a nuclear first strike. If the commitment attribute has a higher priority, then a war plan employing nuclear weapons will be tested; if the use of nuclear weapons attribute is of higher priority, then all feasible conventional alternatives will be pursued first. Priority ratings will be described in more detail below.

WARFIGHTING STYLE ATTRIBUTES

Warfighting style attributes represent an agent's proclivities toward various military planning and operational behaviors.[2] There are four attributes of warfighting style:[3]

- *Risk proclivity*, which describes whether the inherent riskiness of a venture figures into military planning. Risk-averse planners will avoid plans that have low probabilities of success or high costs if the attempt fails, whereas risk-prone

[2] Although these attributes are implemented by the NCL, it is possible for temperaments to influence the behavior of lower elements in the command hierarchy. One way to do this is to have the NCL set temperament-dependent parametric values in lower command level analytic war plans.

[3] On the basis of a suggestion by Peter J. E. Stan, we plan to add a fifth attribute here describing the agent's willingness to delegate authority under stress.

planners will accept such risks or may even ignore risk calculations in their planning. Risk proclivity, then, refers to an agent's *strategic* planning.

- *Operational daring*, or the degree to which plans include innovative and/or risky *tactical* measures, if such measures could be decisive. A risk-averse planner (see immediately above) would never be operationally daring, but a risk-taking planner might be willing to consider plans less conservative than standard doctrine suggests. Examples of operationally daring measures might be long-range airborne operations or precursor cruise missile strikes. But more than any examples, the central idea here is a willingness to entertain nonstandard options. Indeed, many battles have been won (and lost) because of operationally daring moves.

- *Insistence on initiative*, or the perceived need to dictate the level and extent of conflict as opposed to reacting to opponent behaviors. Initiative here refers to actual military engagement, not to preparation.

- *Look-ahead tendencies*,[4] or whether military planners pursue the potential consequence of proposed actions systematically through simulation techniques anticipating outcomes and reactions of the opponent.

As with the strategic orientation attributes, the warfighting attributes have priority ratings. These ratings are on the same scale as the strategic orientation priorities, and attributes from the two themes are comparable in this regard.

FLEXIBILITY ATTRIBUTES

Flexibility attributes are elements of an agent temperament that dictate whether the agent will be able to change its goals and its perceptions of other agents. There are two flexibility attributes:

- *Flexibility of perception* deals with the ease with which an agent can change its perceptions of the nature of another agent, as information is obtained about that other agent's behavior.

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[4] A "look-ahead" is a procedure within the RSAC system that permits a major agent to test the effects of a proposed war plan by running it in a trial mode. For this trial mode, the agent's perception of its opponent is used in place of the real opponent, as the simulation is considered only from the agent's own perspective.

- *Flexibility of objectives* deals with the ease with which an agent can change its general objectives. This might involve changing grand strategy in light of circumstances, or altering the operational objectives that are designed in the service of that grand strategy.

PERCEPTUAL ATTRIBUTES

Perceptual attributes are a major agent's view of the other agent's attributes for strategic orientation and warfighting style. In this sense, they are the NCL's "Red's Blue" and "Blue's Red" that are used in planning as well as in look-aheads. Just as there are priority ratings attached to the strategic orientation and warfighting style attributes to determine their importance in agent planning, so there are perceived priority ratings to predict how the other agent will behave. In this sense, the perception attributes mirror in procedure, if not in content, the actual strategic and warfighting attributes. There is no necessary correspondence between one agent's perception of values of the other agent's attributes and that other agent's real values. For example, a Sam might believe that a particular Ivan is willing to take substantial risks when that Ivan is in fact fairly risk averse. Or, an Ivan might misperceive Sam as expansionistic instead of oriented toward the status quo. In addition to perception attributes for the other major agent, there are two attributes for the perception of the anticipated participation of the agent's own allies and the opponent's allies, respectively. These third party attributes follow the behavior attributes developed for Scenario Agent (Schwabe and Jamison, 1982; Shlapak et al., forthcoming). There are, therefore, eleven perception attributes, as follows:

- *Perception of opponent use of nuclear weapons*
- *Perception of opponent commitment*
- *Perception of opponent expansionism*
- *Perception of opponent containment*
- *Perception of opponent unilateralism*

- *Perception of opponent risk proclivity*
- *Perception of opponent operational daring*
- *Perception of opponent insistence on initiative*
- *Perception of opponent look-ahead tendencies*
- *Perception of own ally participation,* or whether an agent's allies (largely NATO for Sam and the Warsaw Pact countries for Ivan) are committed to participating in planned actions.
- *Perception of opponent ally participation,* or the corresponding perception of the opponent's allies' participation.

Table 1

IVAN/SAM ATTRIBUTES

Attribute	Values of Attribute					
SO1. Use of Nuclear Weapons (prty=):	never-use	no-first/ in-kind	no-first/ warfighting	preemptive	incremental	general-use
SO2. Commitment (prty=)						
-Homeland:	undefended	conv/cautious	conv/determined	nuc/objective	nuc/reactive	
-Vital interest:	undefended	conv/cautious	conv/determined	nuc/objective	nuc/reactive	
-Intrinsic interest:	undefended	conv/cautious	conv/determined	nuc/objective	nuc/reactive	
-Indirect interest:	undefended	conv/cautious	conv/determined	nuc/objective	nuc/reactive	
-Diffuse interest:	undefended	conv/cautious	conv/determined	nuc/objective	nuc/reactive	
SO3. Expansionism (prty=):	status-quo	conservative	opportunistic	adventurous		
SO4. Containment (prty=):	isolationist	accepting	disrupting			
SO5. Unilateralism (prty=):	autonomous	consultative	protective			
WS1. Risk Proclivity (prty=):	risk-taking	pragmatic	risk-averse			
WS2. Operational Daring (prty=):	daring	doctrinaire				
WS3. Insistence on Initiative (prty=):	proactive	preemptive	reactive			
WS4. Look-ahead Tendencies (prty=):	shallow	moderate	deep			
FL1. Flexibility of Perceptions:	rigid	conservative	Bayesian	ahistorical		
FL2. Flexibility of Objectives:	flexible	limit-setting	resolute			
PE1. Perc. of Opp. Use of Nuclear Weapons (prty=):	never-use	no-first/ in kind	no-first/ warfighting	preemptive	incremental	general-use
PE2. Perc. of Opp. Commitment (prty=)						
-Homeland:	undefended	conv/cautious	conv/determined	nuc/objective	nuc/reactive	
-Vital interest:	undefended	conv/cautious	conv/determined	nuc/objective	nuc/reactive	
-Intrinsic interest:	undefended	conv/cautious	conv/determined	nuc/objective	nuc/reactive	
-Indirect interest:	undefended	conv/cautious	conv/determined	nuc/objective	nuc/reactive	
-Diffuse interest:	undefended	conv/cautious	conv/determined	nuc/objective	nuc/reactive	
PE3. Perc. of Opp. Expansion. (prty=):	status-quo	conservative	opportunistic	adventurous		
PE4. Perc. of Opp. Containm. (prty=):	isolationist	accepting	disrupting			
PE5. Perc. of Opp. Unilateral.(prty=):	autonomous	consultative	protective			
PE6. Perc. of Opp. Risk Pro. (prty=):	risk-taking	pragmatic	risk-averse			
PE7. Perc. of Opp. Oper. Dar. (prty=):	daring	doctrinaire				
PE8. Perc. of Opp. Ins. Init. (prty=):	proactive	preemptive	reactive			
PE9. Perc. of Opp. Look. Tend.(prty=):	shallow	moderate	deep			
PE10 Perc. of Own Ally Participation:	noncoordinate	coordinate	noncombatant	cobelligerent	nuclear-releasor	
PE11.Perc. of Opp. Ally Participation:	noncoordinate	coordinate	noncombatant	cobelligerent	nuclear-releasor	

III. ATTRIBUTES AND VALUES

We present here each of the temperament attributes separately, along with the values that each attribute can assume. When a value set is the same as that for a previously described attribute (e.g., perception of a strategic attribute), the list will not be duplicated.

SO1. USE OF NUCLEAR WEAPONS

This attribute represents an agent's general stance toward the use of nuclear weapons. It does not solely determine a decision whether or not to use the weapons, but acts in conjunction with the attribute about commitment and the agent's information about the world situation and its estimates of other agents' likely behaviors.

Values:

1. *Never-use*. This is an agent with a nominal, sincere never-use policy. In a sense, this value represents a control condition to test enemy agent behavior against an avowed no-use policy. It should be remembered, though, that unless the never-use value has the highest priority rating, it is possible that the agent could be pushed to nuclear use by circumstances.
2. *No-first/in-kind*. This agent will not be the first to use nuclear weapons, but will respond in kind to either tactical or strategic use. If an enemy employs tactical nuclear weapons, this agent would, if appropriate, respond in kind (theater nuclear wars), but would not be the first to further escalate to strategic nuclear war.
3. *No-first/warfighting*. This agent will not be the first to use nuclear weapons. However, once the opponent uses any nuclear weapons, then the threshold has been crossed, and the agent will use any degree of nuclear force that it deems appropriate to the situation.[1]

[1] This is arguably the present Soviet *professed* position; of course, their *true* position could be something quite different.

4. *Preemptive*. This agent will not be the first to use nuclear weapons, unless it believes that the enemy is about to escalate to the nuclear level, and that going first will either prevent that strike or mitigate its damage. The scope of a preemptive strike is counterforce against the weapons and support systems that the agent believes will be used: If the threat is tactical, then the preemptive strike will be countertactical; if the threat is strategic, then the preemptive measure will be counterstrategic.
5. *Incremental*. An agent with an incremental nuclear policy does not look to nuclear weapons as a first resort, but will use them if the continued or planned use of conventional weapons looks futile. Use of nuclear weapons under this policy might first be demonstrative (depending on the urgency of time), to communicate the seriousness of the situation and the willingness of the agent to use them, and then, in a later stage, be for military effect. An incremental stance with regard to nuclear weapons is at the heart of a "flexible response" policy such as that held by NATO. Incremental escalation is, like preemption, staged to be as minimal as feasible.[2]
6. *General-use*. An agent with this policy adopts the stance that there is nothing inherently unique about nuclear weapons to make them qualitatively different from other weapons. They are to be used just like other military weapons, when appropriate.[3]

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[2] The two cases of preemption and incrementalism are interesting because if one side has such a policy and misperceives the other side as also having such a policy, then escalation to nuclear war can occur because of misperception.

[3] Given the anticipated response of the enemy to the use of nuclear weapons, even an agent with this attitude is likely to use them sparingly.

SO2. COMMITMENT

This attribute is constructed on a model of concentric shells of commitment. Each shell is defined as a level of national interest, with the most vital interests listed first (in the center). Within each shell, there is a list of geographical areas, countries, or perhaps even regions within countries that are within the shell. For each shell, the agent has a level of commitment to defend that it is willing to undertake rather than lose a member of that shell to the opponent. In this way, then, commitment is specified separately for each geographical area that the NCL considers.

Shells:

a. *Homeland*. For the Soviet Union, this includes all the Soviet Socialist Republics. For the United States, it includes all the States and Territories.

b. *Vital national interest*. Elements of this shell are areas which, for reasons of geographical proximity to the homeland, treaty, tradition, trade, etc., are considered to be of major importance to the agent. One of these areas coming under the control of the opponent would be regarded as calamitous. For the contemporary United States, this category includes Canada, Great Britain, Japan, and the FRG; arguably, all NATO countries belong. For the Soviet Union, the Warsaw Pact countries are in this shell.

c. *Intrinsic interest*. These are areas of less than vital concern, but which still are of major importance. For the United States today, Saudi Arabia, Israel, and El Salvador are representative of perceived intrinsic interests. Corresponding interests for the Soviet Union are North Korea and Afghanistan.

d. *Indirect interest*. These are areas that are not of great importance for themselves, but have symbolic or strategic value. "Domino" countries in a domino theory fit into this category. For areas in this category, it is more important that they not be in the opponent's camp than that they be in

the agent's camp or neutral. But to prevent their falling into the opponent camp, they should be kept in the agent's camp. The classical example of such an area was Indochina for the United States in the 1950s and early 1960s. Arguably, present American interest in Iran and earlier Soviet interest in Angola and Ethiopia fall in this category.

e. *Diffuse interest*. These are areas that do not have a well-defined attachment to an agent, or may even be perceived as being in the opponent's sphere of influence. Therefore, an agent will not contest the other superpower in such an area, but might intervene there if unopposed. The Soviet stance with regard to Grenada and the American reaction to Afghanistan are both characteristic of the diffuse interest shell. In the present world, neither the United States nor the Soviet Union is really disinterested in any part of the globe, so this shell represents a minimum level of commitment.

The structure of shells is always from the perspective of the agent whose policy is under discussion. Thus, Sam has an opinion of which areas are in which shells; this opinion determine's its reaction to action in a country. Ivan also has an opinion of which countries are in which shells; Ivan's opinion may not be complementary to Sam's opinion. Such differences of opinion may lead to war based on real conflict of interest. Also, since an agent's perception of where its opponent places a particular area may be mistaken, such misperceptions can also lead to war based, this time, on misunderstanding.

Although the nominal level of commitment to each shell will not change during the course of an RSAC exercise, the placement of countries within shells can change. Thus, it is possible that a country will move from a diffuse interest shell to an indirect interest shell if an agent feels that should the opponent control that country, another, intrinsic, country would be threatened. One can argue that Grenada made such a shift in American policy during 1983. Or, by agreement between an agent and a third party, mutual protection treaties might move a third party from the intrinsic interest shell to a vital interest shell.

Different levels of commitment, or values, are applicable to each of the shells described above. We distinguish the following levels of commitment:

Values:

1. *Undefended*. A shell with a value on this level will not be protected by an agent. An opponent can safely be contemptuous of an agent in this situation.[4]
2. *Conventional/cautious*. This level of commitment is to provide conventional forces and/or support as long as there are good chances of success, but to abandon the campaign if prospects are not favorable. Recent Soviet policy in the Caribbean area (e.g., Grenada) seems to have been at this level.
3. *Conventional/determined*. This level of commitment is to provide conventional forces, and to keep at it unless total defeat is imminent. However, rather than escalate to nuclear use, the agent will accept defeat. The American involvement in Viet Nam was patently at this level of commitment.
4. *Nuclear/objective*. This level of commitment permits escalation to nuclear weapons if conventional levels of force have failed or appear to be useless, and if it appears that nuclear weapons might help achieve objectives within that shell. Although nuclear weapons arising out of this level of commitment need not follow an earlier conventional effort, the escalation from that lower level would be the more likely sequence, given that there was no surprise attack by the other side. The important distinction for this level of commitment is that the agent believes that nuclear weapons will serve the interests of achieving objectives.

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[4] We must keep in mind that the opponent may mistake the level of commitment, or commitment may change, or the pressures of the situation and other temperament attributes might cause the agent to take action. Again, no temperament by itself can be absolutely definitive in predicting the behavior of an agent.

5. *Nuclear/reactive*. An agent with this level of commitment will escalate to nuclear weapons as a reaction to perceived enemy threats, whether or not the nuclear escalation appears to aid in achieving objectives. Such a policy might involve using nuclear weapons as "revenge," to injure the other side after suffering a successful first strike, or as "standard operating procedures" involving a launch-on-warning, a fatalistic attitude toward the inevitability of nuclear war if events get bad enough, or a willingness to be carried along by the momentum of escalating conflict.

SO3. EXPANSIONISM

This attribute refers to the political empire-building proclivities of major agents and their willingness to use military means to achieve those ends. We exclude from the definition of expansionism economic domination of a country if there is no concomitant military threat or presence that enforces the domination. We also exclude, and reserve for the containment attribute below, the policy of reducing or containing the expansionism of the enemy. Particularly with this definition, then, expansionism is an attribute that is presently appropriate for the Soviet Union, but less appropriate for the United States. Note, however, that there may be Ivans who misperceive this and believe Sam to be expansionist.

Values:

1. *Status-quo*. A status quo power has no inherent interest in pursuing polices of expansion. It should be noted that a status quo power, while it does not seek to expand, will not deliberately shrink its military or political control unless forced to do so by unbearable costs.[5]

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[5] It can be argued that Great Britain had a post WWII policy of shrinking its empire as the costs became overly burdensome. However, during the foreseeable lifetime of this version of RSAC, neither the United States nor the Soviet Union is likely to adopt that stance.

2. *Conservative*. A conservative agent does not hold expansion as a high priority, but will expand if given an almost riskless opportunity to do so. Soviet behavior in Southwest Africa appears to be consistent with conservative expansionism. Once a conservative agent has gained an area, it will not cede it lightly.
3. *Opportunistic*. An opportunistic agent is expansionistic, but only cautiously so. The difference between opportunistic and conservative is that the opportunist will attempt to create situations in which safe expansion is possible, while the conservative will pick up the pieces that look ripe. The Soviet expansion into Afghanistan in 1979 appears opportunistic.
4. *Adventurous*. This agent will expand at some risk; it is always looking for opportunities for expansion. Stalinist policies in the Mediterranean basin in the late 1940s and early 1950s appear to have been adventurous.

SO4. CONTAINMENT

This attribute describes whether an agent has a policy of reducing or containing the empires of the enemy agent. It might also be called "counterimperialism," describing whether an agent wishes to break up the empire of the enemy without regard to how it might wish to expand its own empire.

Values:

1. *Isolationist*. An isolationist agent will not interfere with the expansionist activities of the enemy, as long as its own intrinsic or vital interests are not threatened.
2. *Accepting*. An accepting agent tends not to tolerate new expansionism by the enemy agent, but on the other hand is willing to accept the status quo.

3. *Disrupting*. A disrupting agent is one that, given the opportunity, will attempt to break up the enemy's empire. An American policy that called for the active liberation of the East European countries (while not subsuming them in an American empire) would be disrupting. While agents that are adventurous or opportunistic in the attribute of expansionism are very likely to be disrupting on containment, agents who are disrupting on containment need not be particularly expansionist.

SO5. UNILATERALISM

This attribute describes the degree of autonomy that an agent claims. It is meant to capture the tendency of an agent to act on its own without waiting for consultation with allies, or to act in its own interest without taking into consideration the interests of allies. The contemporary Soviet Union is adamantly unilateral, whereas the United States may vary, depending on circumstances and the particular administration in office.[6] Therefore, most versions of Ivan will have a value of autonomous for unilateralism, whereas different Sams may vary on this attribute. It is logically possible (but not likely) that a Sam could misperceive Ivan's demand for total autonomy.

Values:

1. *Autonomous*. This agent insists on decisional autonomy with respect to all policy and tactical decisions.
2. *Consultative*. A consultative agent will consult allies, but reserves the right to take unilateral action whenever it deems it appropriate.
3. *Protective*. A protective agent will take unilateral action only under severe threat to its own forces or a threat to its homeland.

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[6] No superpower, however, is likely to forfeit its ability to take unilateral action should the circumstances demand it.

WS1. RISK PROCLIVITY

This attribute attempts to capture the willingness of an agent to take risks to achieve objectives. It is a measure, therefore, of willingness to sustain losses set against what can be gained by a particular military move.

Values:

1. *Risk-taking*. A risk taker will choose plans that involve the risk of losses for a relatively small probability of major gain or plans that are likely to be successful but have small but significant likelihoods of large losses. This can come about either because the agent is consciously willing to take risks or because the riskiness of a plan is not a component of the agent's planning calculus.
2. *Pragmatic*. The pragmatic agent will take risks when analysis indicates that there is a good likelihood of positive gain, i.e., when the expected outcome is positive. When the expected outcome is sufficiently positive, the pragmatic agent is willing to risk sustaining serious losses.
3. *Risk-averse*. A risk avoider seeks to avoid losses unless gains are virtually assured. Such an agent will forgo opportunities for major gains if there are risks, even of moderate magnitude or likelihood, of losses. However, once in a "no win" situation of choosing among alternative losses, even the risk-averse agent will behave in a manner more approximating a pragmatic agent.[7]

[7] This feature of risk proclivity is based on psychological studies of how people differ in the degree of risk they are willing to take depending on whether they are facing gains or losses.

WS2. OPERATIONAL DARING

This attribute describes the willingness of the agent to undertake military operations that deviate from the relatively traditional steps dictated by military doctrine. It is in part a measure of military creativity, and indicates an openness to ideas that might have been previously rejected out of hand or that have not been thought of before. Again, there is an inherent riskiness involved in being operationally daring, so that agents high on this attribute are likely to be risk takers. Risk takers, though, need not be operationally daring.

Values:

1. *Daring*. Willing to consider daring tactics with strategic significance. If a plan suggests itself that is unorthodox but may have a large favorable impact on achieving objectives, that plan will be seriously entertained.
2. *Doctrinaire*. Does not consider novel plans; sticks to standard doctrine and alliance-approved plans.

WS3. INSISTENCE ON INITIATIVE

This attribute has to do with the acceptability of allowing an opponent to escalate rather than seizing the initiative oneself to escalate a conflict from the current situation. It is meant to distinguish between agents having a largely second-strike philosophy as opposed to those with a largely preemptive one.

Values:

1. *Proactive*. The proactive agent places a high value on having the opponent react to its own behaviors rather than having to react to the behavior of the opponent. It will therefore try to dictate the pace of the war, escalating rather than reacting to escalation, and spreading rather than reacting to the spread of a war.

2. *Preemptive*. Preemptive agents are not by principle proactive, but consider it important to anticipate any opponent escalation or spreading of the conflict and to go first, so as to either reduce the effect of opponent action or, by communicating resolve in preemption, to prevent a full-scale escalation or further spreading of conflict.
3. *Reactive*. A reactive agent will escalate or spread only when the current situation is a losing one and further escalation or spreading significantly improves prospects. In general, a reactive agent looks to second-strike responses rather than proactive behaviors.

WS4. LOOK-AHEAD TENDENCIES

This attribute has to do with the extent to which the agent looks ahead to the possible consequences of war plans before deciding to implement them. It provides a measure of planning cautiousness as opposed to operational cautiousness (or daring), and governs the extent to which the agent uses "Red's Blue" or "Blue's Red" images in choosing among plans.

Values:

1. *Shallow*. This agent generally does not use look-aheads in planning.
2. *Moderate*. A moderate agent uses look-aheads in situations that are considered relatively critical, but may eschew them when the situation appears unambiguous.
3. *Deep*. The deep agent relies on extensive look-aheads as part of its planning policy.

FL1. FLEXIBILITY OF PERCEPTIONS

This attribute governs the ease with which the agent will change the perception of another agent's strategic and warfighting style attributes. The more flexible an agent is, the more it will consider the opposing agent's actual behavior in forming perceptions; the more

rigid an agent, the more it will stick to prior opinions. An agent intermediate in flexibility will modify opinions in the light of growing evidence, not shifting hastily, but eventually coming to have perceptions formed by the weight of accumulated past experience. In terms of anticipating an opponent's response to a bargaining or tactical move, flexibility of perceptions can be of major importance. Although the value of this attribute will not itself be changed during the course of an RSAC run, flexibility of perception can change in times of great stress (which can be defined in terms of loss of C^3I capability and imminent danger to the homeland). In such conditions, most versions of the agent will adopt a more rigid posture and maintain a worst-case view of the enemy, no matter what its nominal flexibility of perception and no matter what its earlier perceptions may have been.[8]

Values:

1. *Rigid*. The rigid agent will stick to original perceptions no matter what evidence to the contrary is generated. Although such an agent would not deny the reality of facts counter to its beliefs, it would, to a marked degree, regard these facts as special cases and continue to believe that their "logical" consequences would not occur. An exception to this rigid maintenance of perceptions is if extreme stress is put on the agent, in which case it will adopt "worst-case" perceptions in place of any it may have held previously.[9]
2. *Conservative*. A conservative agent will maintain present perceptions unless strongly dissuaded by events. By "strongly dissuaded," we mean that not only the immediate situation, but

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[8] There is a considerable body of psychological evidence supporting the contention that in times of stress, individuals often revert to perceptions and behaviors that are *a priori* predominant, and ignore what information or other cues they might possess that would lead to different perceptions or behaviors. In the stress of decapitation or imminent homeland damage, the dominating impression will be one of facing a relentless and extremely malevolent enemy.

[9] We anticipate that most rigid agents would also begin with "worst-case" views of the enemy, although we hasten to caution that the "worst-case" view does not in turn imply rigidity.

also its proximate history, is severely inconsistent with the agent's perceptions.

3. *Bayesian*. A Bayesian[10] adjusts opinions in light of new evidence, with original opinions taken into account. This agent changes opinions gradually, but consistently with the evidence. From a decision analytic point of view, this agent behaves optimally, hence the name Bayesian.
4. *Ahistorical*. This agent ignores the past and adopts as its perception the best explanation for the most recent opponent behavior. Perceptions may therefore make dramatic and rapid shifts, and a seemingly contradictory policy may result.

FL2. FLEXIBILITY OF OBJECTIVES

This attribute indicates the extent to which an agent is willing to change long-term objectives in light of the changing opportunities and limitations that present themselves over the course of a campaign.

Values:

1. *Flexible*. A flexible agent will alter objectives both to exploit opportunities and to prevent losses.
2. *Limit-setting*. A limit-setting agent is flexible until it finds itself in a shooting war in Europe. At this point, it becomes resolute, and will not back down. It will, however, continue to exploit opportunities after escalation to European war.
3. *Resolute*. A resolute agent will pursue a given objective until the objective is patently impossible. Opportunities will only be exploited to the extent that they fit given objectives.

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[10] The Bayesian branch of mathematical statistics starts with subjective estimates and revises them as objective data become available.

PE1-9. PERCEPTIONS OF STRATEGIC ORIENTATION AND WARFIGHTING STYLE

These attributes are one agent's *belief* about what the other agent's value is on the nine attributes of strategic orientation and warfighting style discussed immediately above. They function, therefore, both as attributes for the agents who own them and as the opponent agent's attribute in look-aheads.[11] We recapitulate the labels of these attributes:

PE1. Perception of opponent nuclear use.
PE2. Perception of opponent commitment.
PE3. Perception of opponent expansionism.
PE4. Perception of opponent containment.
PE5. Perception of opponent unilateralism.
PE6. Perception of opponent risk proclivity.
PE7. Perception of opponent operational daring.
PE8. Perception of opponent insistence on initiative.
PE9. Perception of opponent look-ahead tendencies.

PE10. PERCEPTION OF OWN ALLY PARTICIPATION

This is a best guess of what one's own allies will do at the present state of the world. Although we would prefer a perception of participation variables for each of one's allies (and, indeed, Scenario Agent will supply an action for each relevant ally), our global perception measure must suffice for the present. It provides the agent with an estimate of the level of support it can get from an ally for actions the agent contemplates. The values for this attribute are derived from, but are not the same as, levels of cooperation defined for Scenario Agent (Shlapak et al., forthcoming).

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[11] It is perhaps worth saying that the agent always believes its own perceptions to be accurate; the flexibility of perceptions (above) provides for the ability of the agent to alter those perceptions. For the time being, we do not address the important problem of the degree of certainty an agent has about its own beliefs.

Values:

1. *Noncoordinate*. In essence, this is a noncooperative ally who refuses to grant land, sea, or air transit rights for the military forces of the allied major agent.
2. *Coordinate*. This is an ally who will grant transit rights, but will not make any of its own military or nonmilitary resources available.
3. *Noncombatant*. A noncombatant ally grants transit rights and allows the use of its territory by the combat forces of its superpower ally as a staging and launch area, but its own military forces remain unavailable for joint action.
4. *Cobelligerent*. A cobelligerent ally releases its own military forces (short of nuclear weapons) to the superpower for coordinated joint effort.
5. *Nuclear-releasor*. This ally cooperates to the maximum extent with its superpower ally and will agree to allow the use of nuclear weapons (either its own, or the superpower's weapons launched from its country).

PE11. PERCEPTION OF OPPONENT ALLY PARTICIPATION

This attribute corresponds to perception of own ally participation, as described above, except that it is the agent's perception of the opponent's allies instead of its own allies. Here, the issue is how much the agent expects the opponent's allies to support the opponent.

IV. PRIORITY RATINGS

Priority ratings accompany each of the strategic orientation and warfighting style attributes enumerated above, as well as their perception attribute counterparts. These ratings govern the way in which the strategic orientation and warfighting style attributes determine agent behavior. (For the perception attributes, the ratings are used to predict opponent agent behavior.) Such governance operates in two instances: first, when an attribute's value "gets in the way" of pursuing a desirable objective, and second, when two attributes posit contradictory behaviors.

We anticipate that from time to time there will be a behavioral option available that is desirable from the point of view of achieving an objective, but runs counter to a political orientation or to a warfighting style. For example, it may be that a look-ahead reveals the possibility of succeeding at achieving an objective if a certain operationally daring but high-risk strategy is taken, but the warfighting style of this particular agent is conservative. Then, if the priority rating of the attribute of operational daring is relatively low, the agent will be more flexible, and the potential benefits of the action can outweigh the proclivity of temperament. On the other hand, if the priority rating of operational daring is high, then the agent will be inflexible in that regard.

The priority ratings also provide a means of resolving contradictory prescriptions from two or more temperaments whose implications are in conflict. For example, consider a Sam with a value of "preemptive" for use of nuclear weapons and a value of "consultative" for unilateralism. Assume further that its intelligence indicates the high likelihood of a potential Soviet nuclear strike but that the NATO allies are against first use. If the use of nuclear weapons attribute has a higher priority rating than the unilateralism attribute, then Sam will first consider escalation to demonstrative nuclear weapons, whereas if unilateralism has the higher priority, then this escalation will not be considered unless other plans fail.

Flexible agents are characterized as having relatively low priority ratings for most of their political and warfighting style attributes. Such agents' behavior is more governed by situational determinants, and they might present an inconsistent and confusing picture to both opponents and observers. Rigid agents, on the other hand, place high priority ratings on most of their attributes. As a consequence, their behavior is largely governed by negative constraints from their attributes, and they will be perceived as not attending enough to the world situation. Selective agents (as most agents used in RSAC research will probably be) hold some attributes as important and others as less central to their decisionmaking. For more flexible agents, then, strategic orientation and warfighting style give more of a guideline to behavior than a prescription. On the other hand, less flexible agents interpret strategic orientation and warfighting style to bound more strictly what plans are admissible. Selective agents are bound by the dictates of some attributes, but deviate from the proclivities of others.

The range of flexibility of an agent is in part determined by the distance in policy between a value held for an attribute and a different value for the same attribute that would support the policy that is inconsistent with the first value. If an attribute takes on a certain value, we shall consider the values above and below the nominal one to be a single *ordinal step* from it. For example, if an agent has a value of "conservative" on the attribute expansionism, then the two values "status-quo" and "opportunistic" are each one ordinal step from "conservatism." "Adventurous" is two ordinal steps from "conservative" for this attribute. These ordinal steps are therefore a rank-ordered measure of the distance between values on a single attribute. If an attribute is not rank ordered with respect to its values, then any change from one position to another is considered a single ordinal step.

Priority ratings range from 1 to 5, and are assigned to each of the strategic and warfighting style attributes as follows:

1. This weakest priority rating indicates that an attribute is easily subject to change. An attribute with a rating of 1 will yield when in conflict with another attribute. An attribute with this low priority will admit for consideration war plans that specify behaviors within one ordinal step of its value. The attribute will be disregarded if there are no feasible plans consistent with the value of the attribute.
2. This rating is a compromise judgment between 1 and 3. An attribute with this rating behaves similarly to an attribute with a rating of 1 with respect to use in isolation.
3. This score indicates an attribute that is moderately held. Such an attribute will permit the considerations of plans within one ordinal step of its value if otherwise there are no plans.
4. This rating represents a compromise judgment between 3 and 5. An attribute with this rating behaves similarly to an attribute with a 3 rating with respect to use in isolation.
5. This rating indicates an inflexibly held policy. The agent will not consider any plans whose actions are inconsistent with the value of this attribute. If two priority 5 attributes are in conflict, then the one prescribing inaction will prevail, based on a principle that it is easier to maintain a status quo than to undertake new actions.

When two attributes of differing priority ratings are in conflict, and if the difference in ratings is two or greater, then the higher valued one will prevail. If the difference is only one, then the agent can engage in behavior within one ordinal step of the attribute's nominal value. When more than two attributes are involved in the conflict, the highest-valued priority rating on the side of an argument shall be the one in force.

If two attributes of equal priority ratings are in conflict, and if they are both low ratings (1 or 2), then behavior within one ordinal step of each is admissible. Otherwise, the attribute prescribing inaction or no change will prevail.

In closing, it is important to note that the strategic orientation and warfighting style attributes do not themselves change value in this formulation. Instead, behavior at variance with the temperament is permitted, with the degree of variance acceptable being determined by the priority or centrality of the attribute in question.

V. A BRIEF VERSION OF TEMPERAMENT

The model of temperament presented above is most useful for the expert writing a set of rules for a major agent; for the person more interested in a brief understanding of an agent, or for purposes of discussion before undertaking a rule-writing task, a shorter list is very helpful. Below are presented separate lists for specifying Red Agents (Ivan) and Blue Agents (Sam); the basic differences between the two types of agent and the brevity requirements of the "short list" of attributes mandate that the lists be separate.

The lists below are not unique, but are intended to serve as examples of such short lists. In discussing the different Sams and Ivans, each of the various rule writers working on the NCL part of RSAC created his own private short list; the one presented is a consensus compilation of these various individual lists that attempts to condense the basic features of the full model of temperament. Other "short lists" could be equally useful; indeed, the reader is invited to try his own hand at writing them.

The five Ivan attributes are:

1. Use of nuclear weapons
2. Warfighting style
3. Decision style
4. Expansionism
5. Perception of opponent commitment

The five Sam attributes are:

1. Use of nuclear weapons
2. Warfighting style
3. Decision style

4. Commitment
5. Alliance dependence

The values that each of the attributes may assume are shown in the following tables.

Note that the first three attributes are common to both Ivan and Sam. The use of nuclear weapons attribute is present in the full model, and is considered of major importance. For the short form, though, the number of values that the attribute can take on is cast in a 2 by 3 conceptualization, where the first dimension is whether nuclear weapons are primarily for deterrence or warfighting, and the second dimension is whether the agent would adopt a no first use, a preemptive, or an escalative policy. Although the attribute specifically addresses only nuclear policy, there are overtones of risk proclivity present; an escalatory agent is one who is very likely to be risk taking.

The warfighting style attribute is an amalgam of the warfighting variables in the full model; these attributes have been used in virtually all models of temperament considered within the RSAC and may not easily be dispensed with. The values for this attribute are cast in a 2 by 2 conceptualization, with the first dimension reflecting whether the agent escalates in an incremental or a massive manner and the second indicating whether the agent is essentially responsive to moves and signals from the opponent or insists on maintaining the initiative.

Decision style is carried over directly from the full model, with no alteration of attribute values. However, in the present context, it is meant to combine in an intuitive way the attributes of flexibility of objectives, flexibility of perceptions, and look-ahead tendencies.

The two unique Ivan attributes are important. The nature of Soviet expansionism is a question that drives much of American policy, and as such has been a major focus for RSAC. Ivans differing on this attribute may well be riposted by different American strategies; the truth of this is a question of importance for the entire RSAC endeavor. The perception of opponent commitment in this shorter form is meant to capture a Red Agent's anticipation of how Blue will react to possible Soviet aggrandizement, and, as such, is an amalgam of several of the

Table 2

SHORT LIST OF IVAN ATTRIBUTES

Attribute	Values of Attribute					
Use of Nuclear Weapons:	deterrent/ no-first-use	deterrent/ preemptive	deterrent/ escalative	warfighting/ no-first-use	warfighting/ preemptive	warfighting/ escalative
War-fighting Style:	incremental/ responsive	incremental/ initiating	massive/ responsive	massive/ initiating		
Decision Style:	highly-analytic	analytic-mixed	reflexive			
Expansionism:	conservative	opportunistic	adventurous			
Perception of Opponent Commitment:	isolationist	vital-interests	realpolitik			

Table 3

SHORT LIST OF SAM ATTRIBUTES

Attribute	Values of Attribute					
Use of Nuclear Weapons:	deterrent/ no-first-use	deterrent/ preemptive	deterrent/ escalative	warfighting/ no-first-use	warfighting/ preemptive	warfighting/ escalative
War-fighting Style:	incremental/ responsive	incremental/ initiating	massive/ responsive	massive/ initiating		
Decision Style:	highly-analytic	analytic-mixed	reflexive			
Commitment:	isolationist	vital-interests	realpolitik			
Alliance Dependence:	dependent	consultative	autonomous			

perception attributes from the full model into a single capsule statement. The values for this attribute are simplistic in the extreme, and attempt to give a high-school textbook definition of policy.

The two unique Sam attributes are commitment and alliance dependence. Commitment, which is the counterpart to the the perception of opponent commitment for the Red Agents, represents in the same simplistic way American military policy. If Sam is playing realpolitik games, then it will tend to be vigilant and reactive to any Soviet adventures; if, on the other hand, Sam is isolationist, then the Soviet Union can safely be contemptuous of it. The alliance dependence variable combines unilateralism and perception of own ally cooperation, again in the sense that the two are probably fairly highly correlated in the real world. This attribute is an important one that distinguishes among the major Blue Agents that have been considered in early NCL modeling.

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